



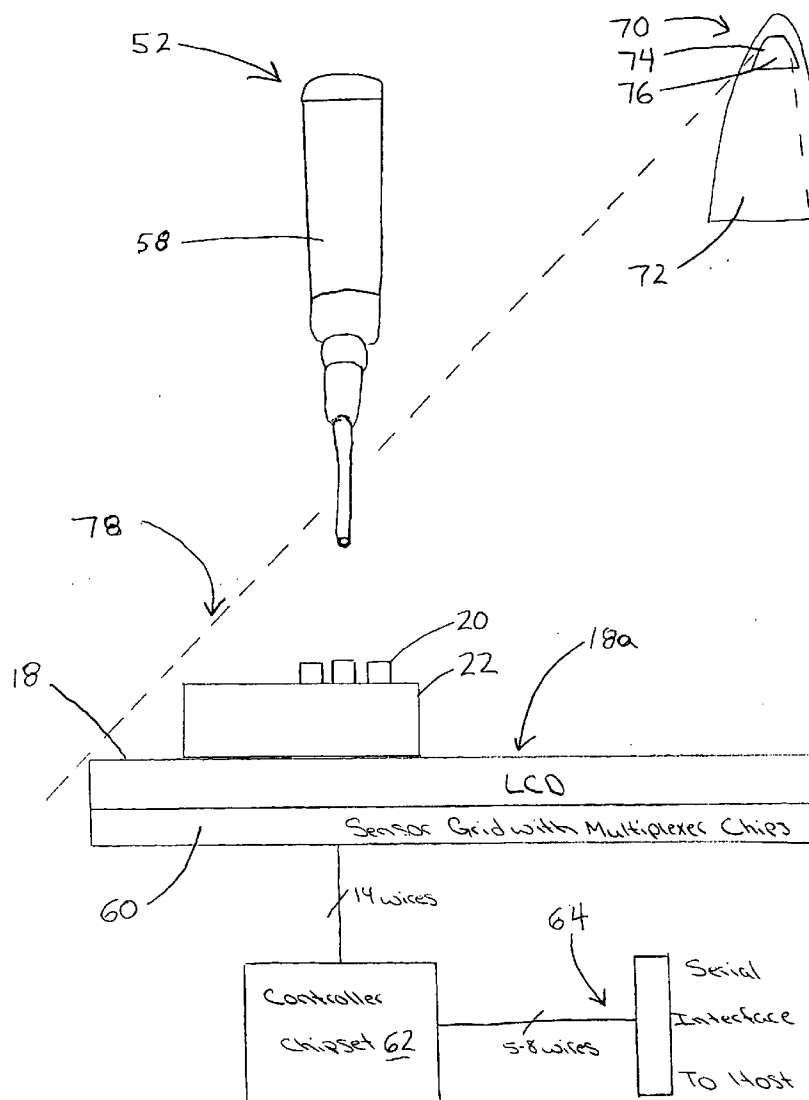
US 20060188406A1

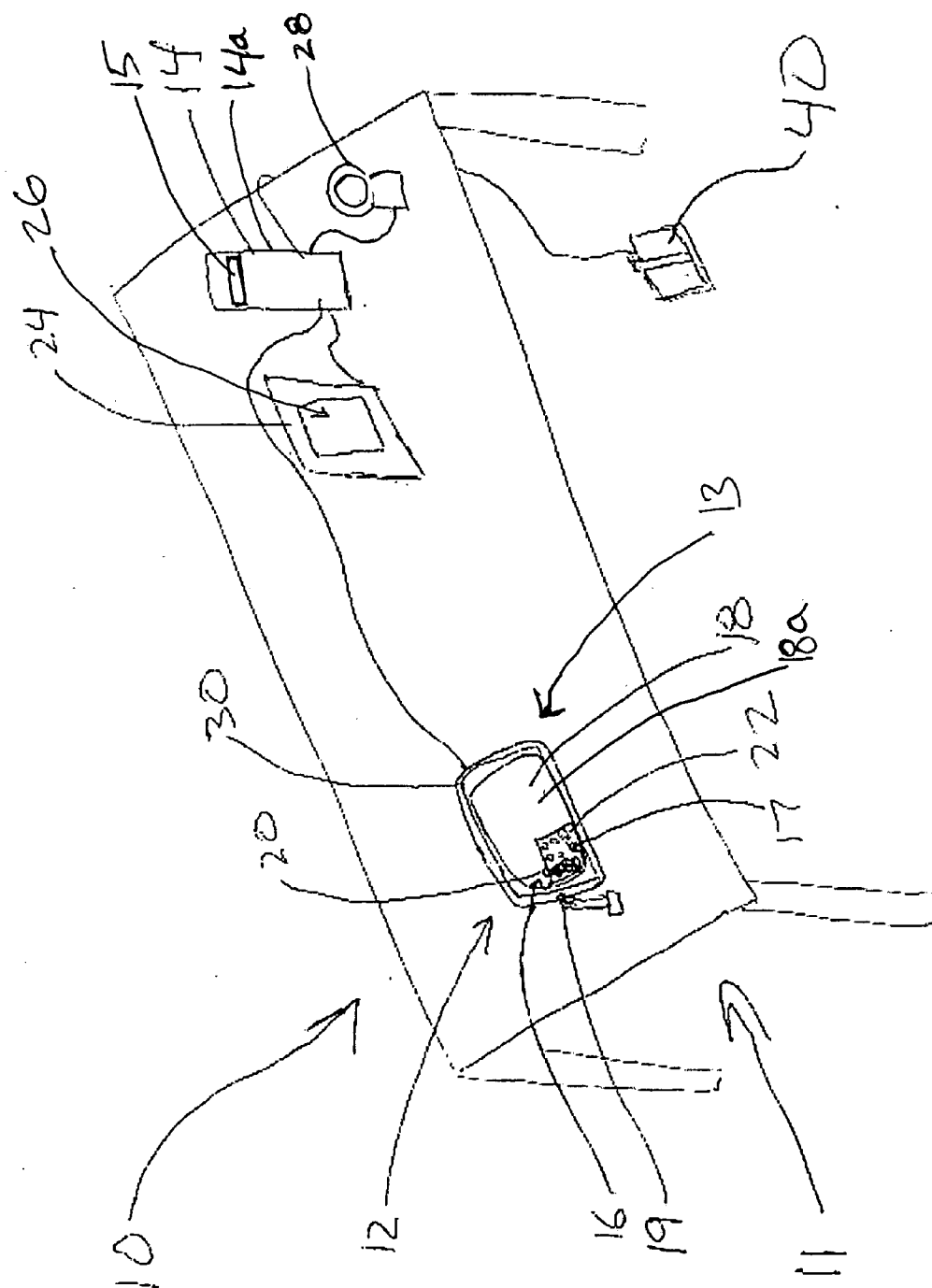
(19) **United States**(12) **Patent Application Publication**
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HOUSTON, TX 77098 (US)(57) **ABSTRACT**(21) Appl. No.: **11/189,456**(22) Filed: **Jul. 26, 2005****Related U.S. Application Data**(63) Continuation-in-part of application No. 11/061,976,
filed on Feb. 18, 2005.

A semi-automated pipetting apparatus has a computer monitor with a screen lying in at least a nearly horizontal plane. A screen protector is mounted over the screen. A processing unit runs a computer program and is in communication with the computer monitor to generate a screen display shown on the screen. The screen display indicates at least one target location for the placement of a vial, for pipetting or for sorting of items.





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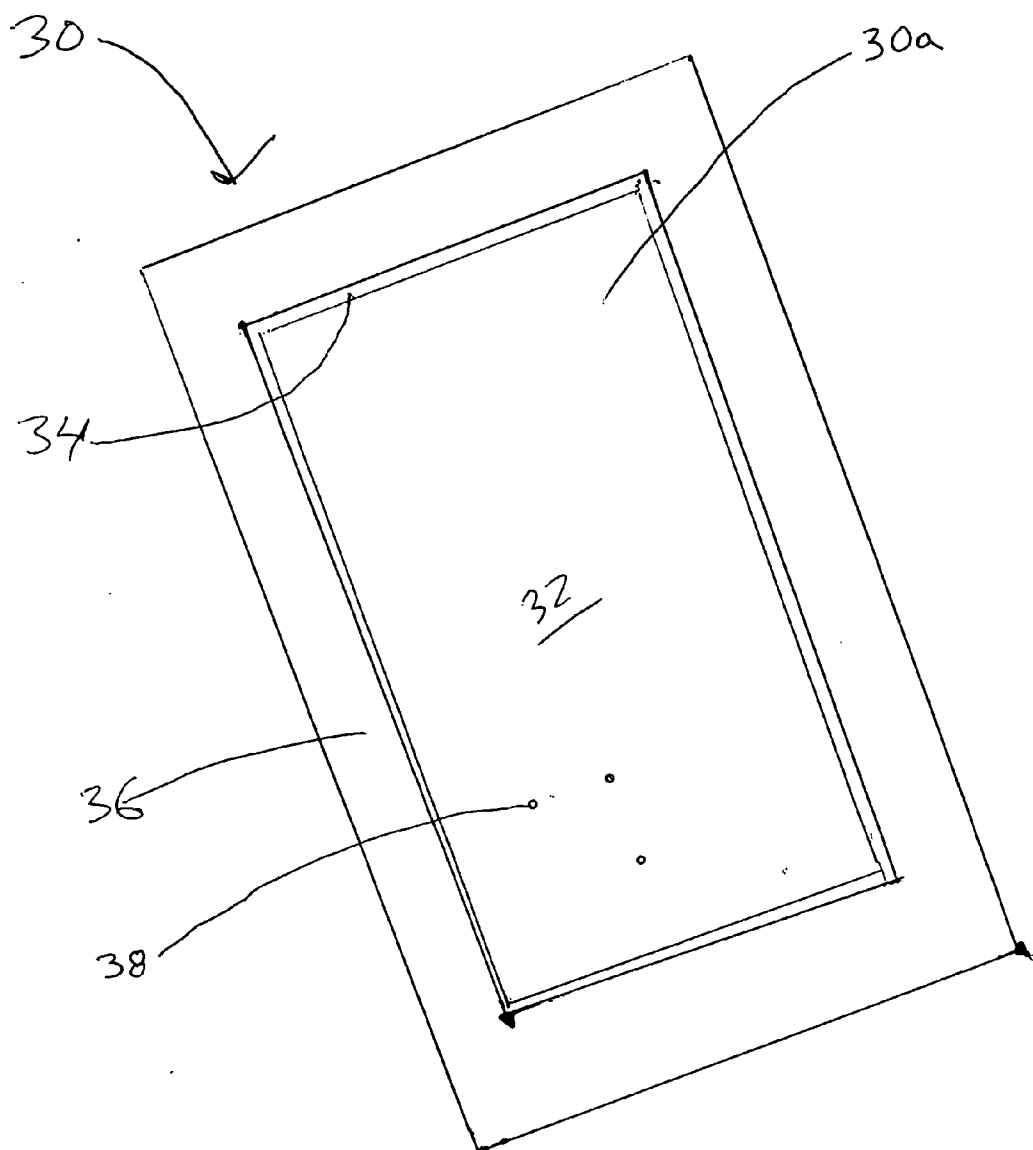
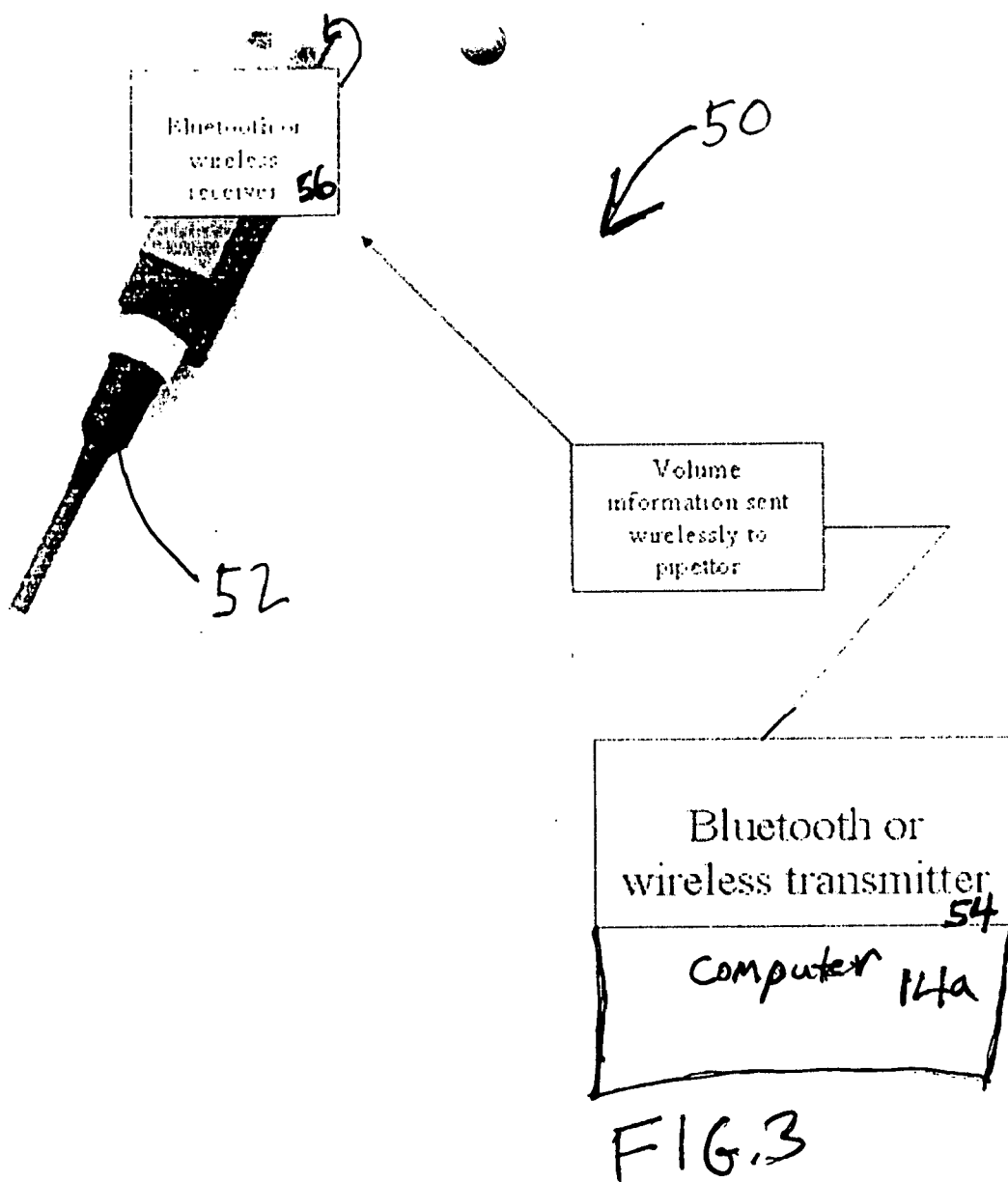


FIG. 2



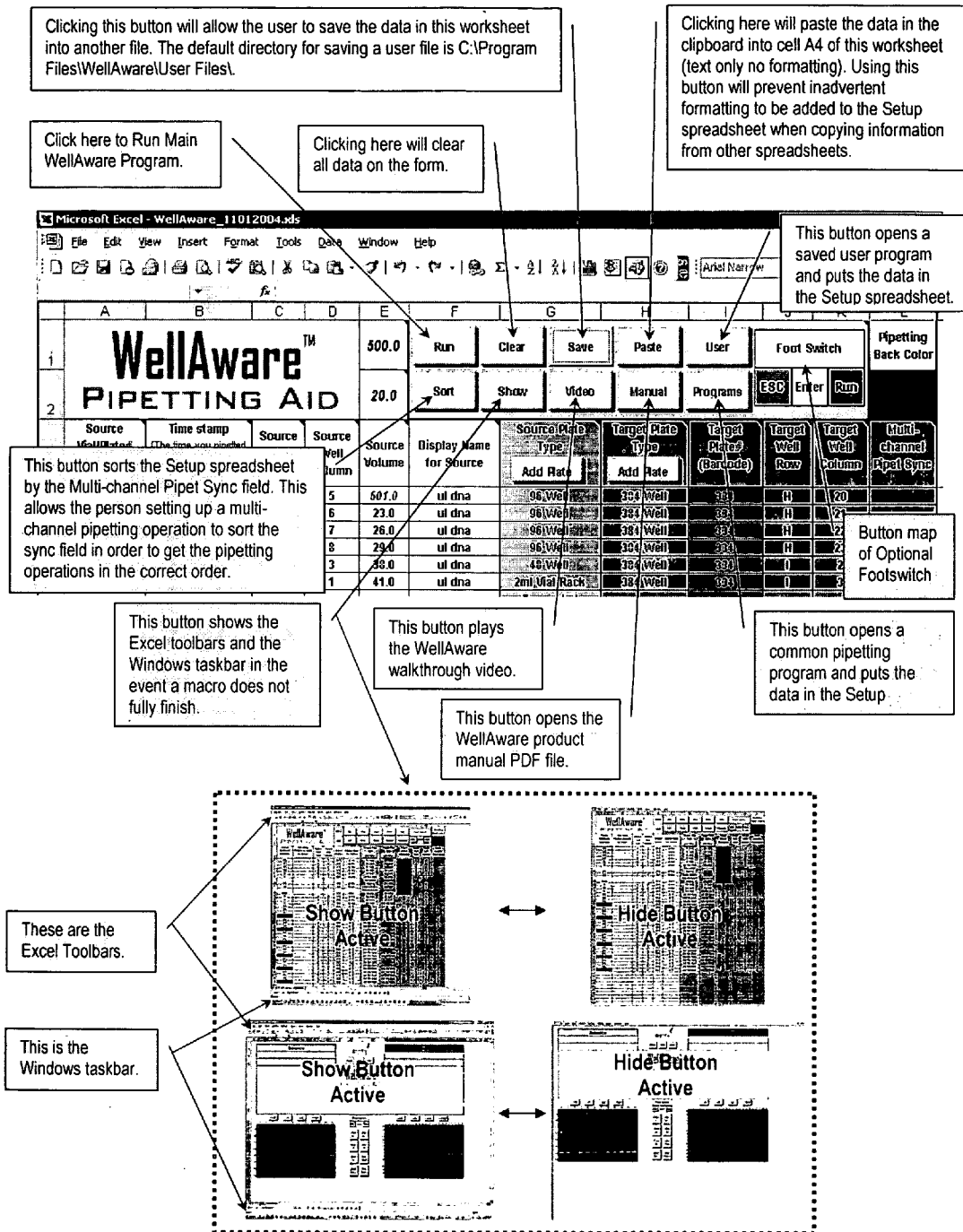


Figure 4
WellAware Setup Spreadsheet Main Button Descriptions

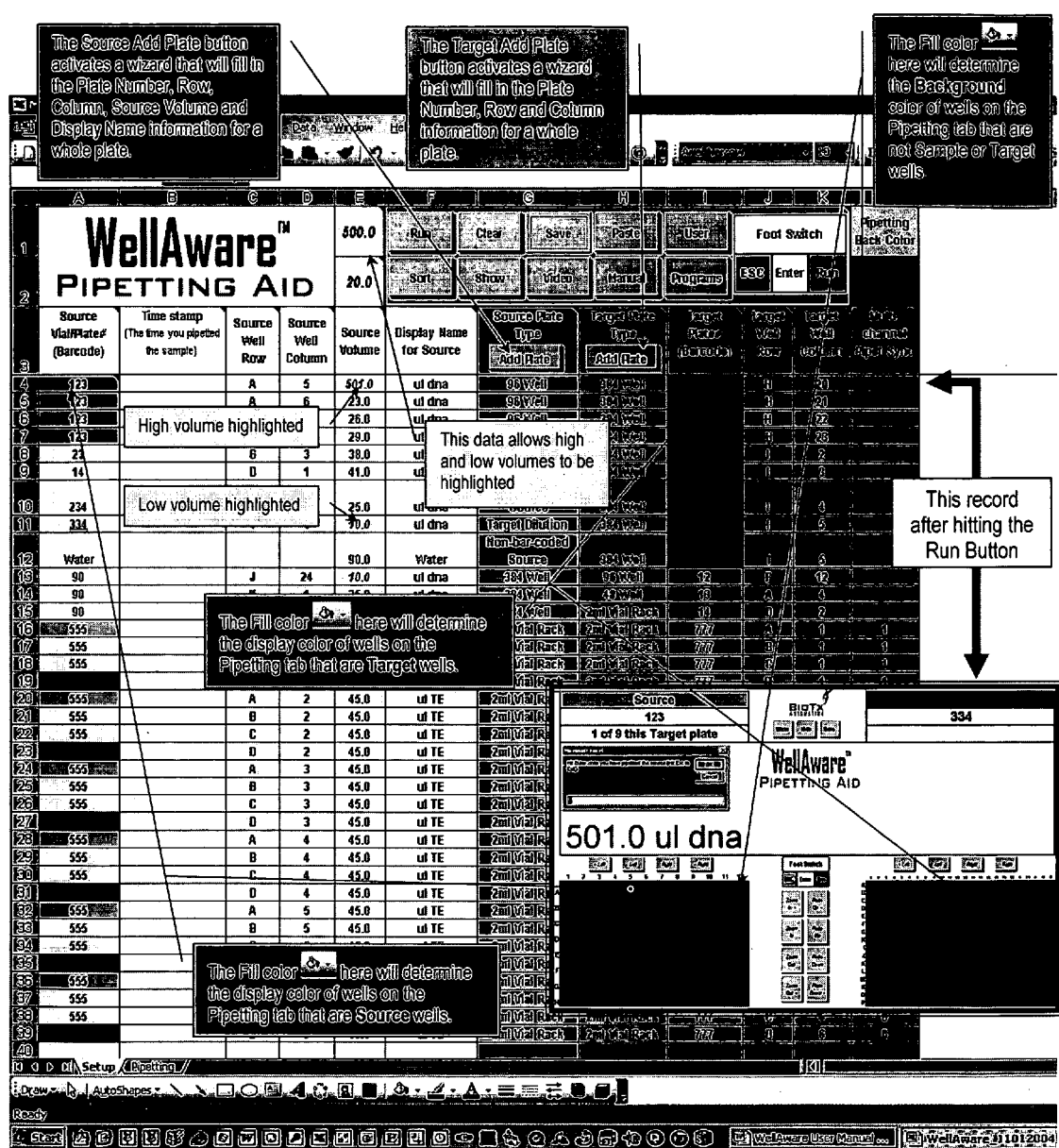


Figure 5
WellAware Setup Spreadsheet Features

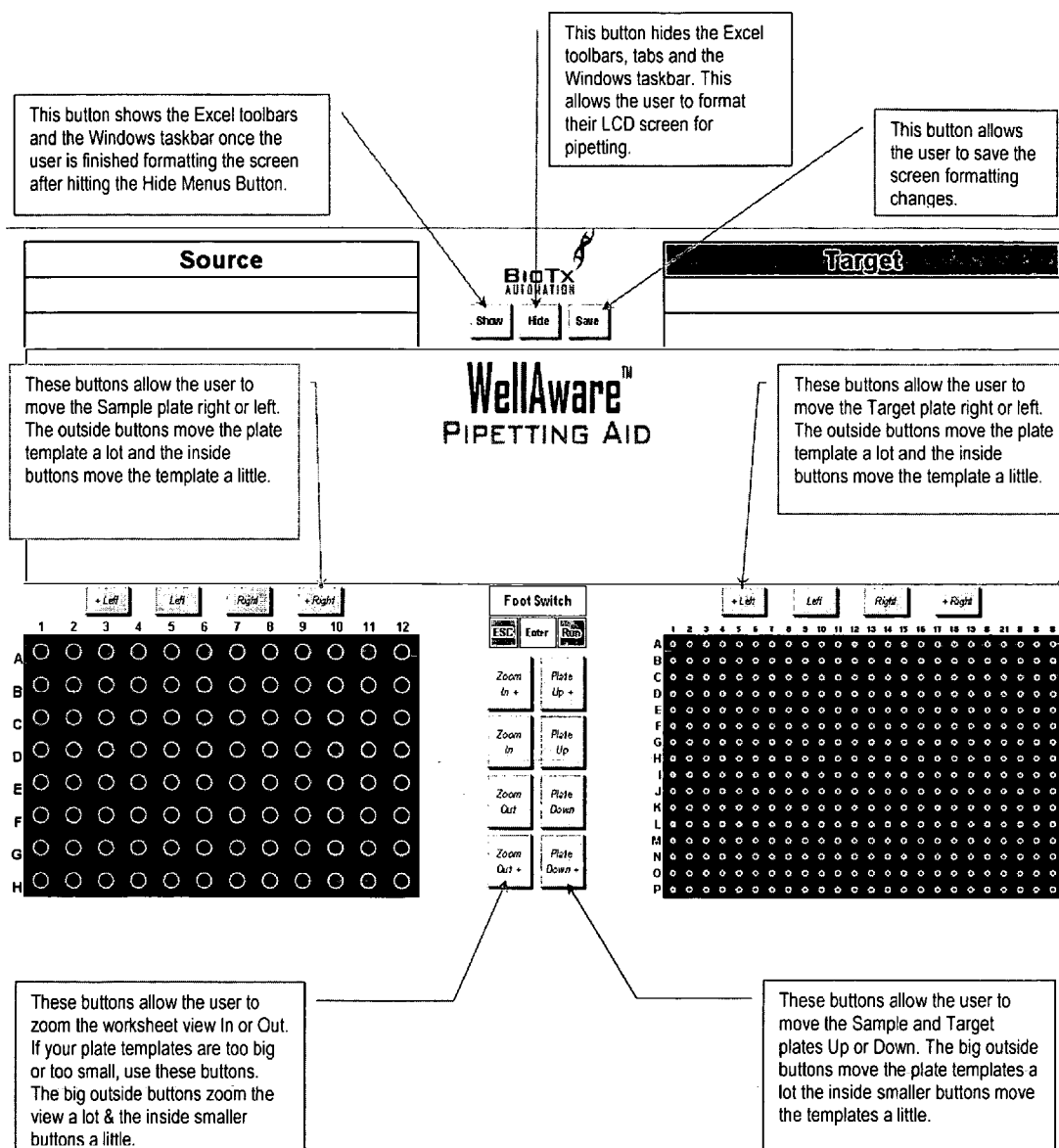


Figure 6
The Pipetting Tab Button Descriptions

Instructions for the WellAware LCD calibration:

1. Click the WellAware Pipetting Tab and click the Edit button
2. Put a 384-well plate onto the LCD screen over one of the 384 well templates and adjust the zoom so that the yellow dots are centered under each well of the plate.
3. Next put the 384-well plate along the bottom of the LCD screen and adjust the plates up or down until the bottom row of the 384 well template is centered on the bottom row of the 384 well plate.
4. Now put the 384-well plate in the lower left corner of the LCD screen and adjust the Source plate template until all wells are centered.
5. Move the 384 well plate to the lower right corner of the screen and do the same adjustment for the Target plate.
6. Once you are happy with the adjustments to your pipetting template, hit the Save button.

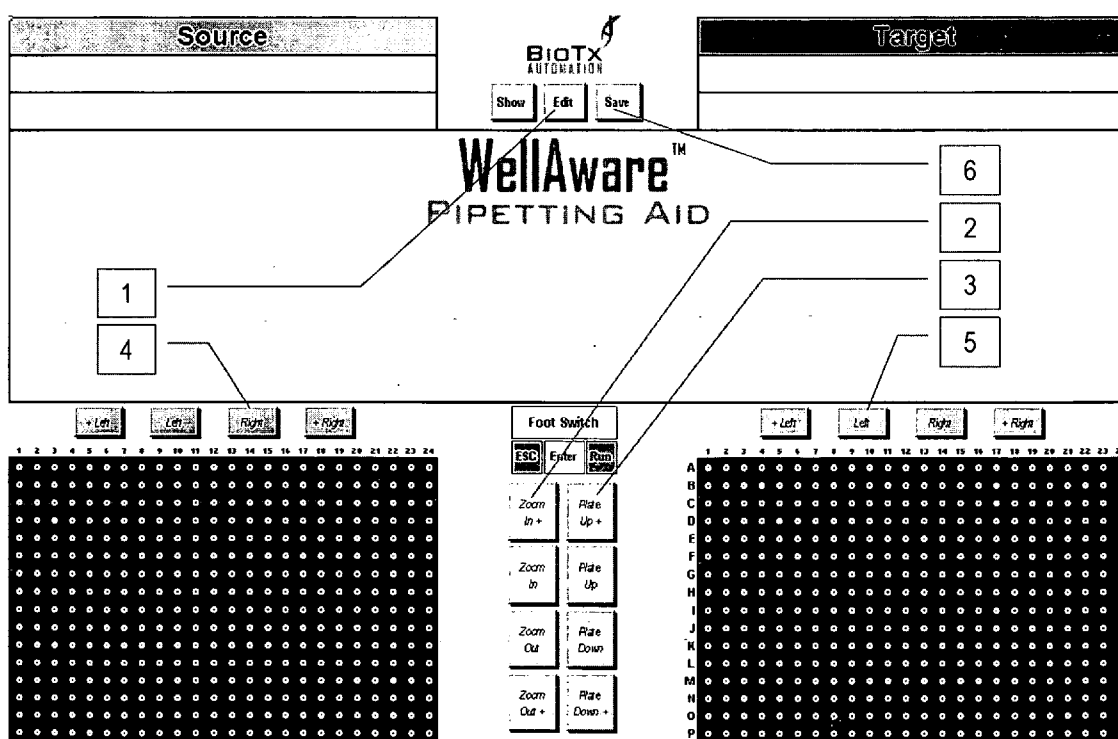


Figure 7
Suggested button order for calibrating the LCD screen

This column contains a Time stamp that is recorded into this field by the Main program. A time stamp is recorded automatically every time the operator acknowledges a pipetting action. The user should leave this blank or the main program will skip that record.

View Figure 6 to see this record on the Pipetting tab while the main program is running.

View Figure 7 to see this record on the Pipetting tab while the main program is running.

This column contains the Plate number or barcode for the Source. In the case of a vial, it should contain a unique barcode for the vial.

This column contains the Source well row information.

This column contains the Source well column information.

This column contains the Source volume to be pipetted.

These columns contain the Source well row and column information. Since the Pipetting Form selection is for a bar-coded or non-bar-coded Sample, the spreadsheet will format the cells red to alert the operator that it is a vial and not a plate.

This is the Target Plate Type to be used for the Target. Use the pull down list to select the correct form.

This column contains the Plate number or barcode for the Target.

This column contains the Target well column information.

This column contains the Target well row information.

This column contains the Multi-channel Pipet Sync information which allows multiple wells to be lit up at the same time. All characters that are the same and are consecutive will be lit up at the same time. This feature allows for multi-channel pipetting.

This column contains the Source name and the volume to be displayed on Pipetting tab.

This is the Source Plate Type to be used for the Source plate. Use the pull down list to select the correct form.

Source Volume	Display Name for Source	Source Plate Type	Target Plate Type	Target Plates (Barcode)	Target Well Column	Target Well Row	Multi-channel Pipet Sync		
500.0	Run	Clear	Save	Rate	User	Foot Switch	Pipetting Back Color		
20.0	Sort	Show	Video	Manual	Programs	ESC	Enter		
123	A	5	501.0	ul dna	96 Well	384 Well	334	H	23
123	A	6	23.0	ul dna	96 Well	384 Well	334	H	21
123	A	7	26.0	ul dna	96 Well	384 Well	334	H	22
123	A	8	29.0	ul dna	96 Well	384 Well	334	H	23
23	O	3	38.0	ul dna	48 Well	384 Well	334	I	2
14	O	1	41.0	ul dna	2nd Vial Rack	384 Well	334	I	3
234	I	4	25.0	ul dna	Bar coded Source	384 Well	334	I	4
334	I	4	19.0	ul dna	Target Dilution	384 Well	334	I	5
Water			90.0	Water	Source	384 Well	334	I	5
98	J	24	10.0	ul dna	384 Well	48 Well	13	A	12
98	K	1	25.0	ul dna	384 Well	48 Well	13	A	12
98	K	2	20.0	ul dna	384 Well	2nd Vial Rack	14	D	2
555	A	1	45.0	ul TE	2nd Vial Rack	2nd Vial Rack	777	A	1
555	B	1	45.0	ul TE	2nd Vial Rack	2nd Vial Rack	777	B	1
555	C	1	45.0	ul TE	2nd Vial Rack	2nd Vial Rack	777	C	1
555	D	1	45.0	ul TE	2nd Vial Rack	2nd Vial Rack	777	D	1
555	A	2	45.0	ul TE	2nd Vial Rack	2nd Vial Rack	777	A	2
555	B	2	45.0	ul TE	2nd Vial Rack	2nd Vial Rack	777	B	2
555	C	2	45.0	ul TE	2nd Vial Rack	2nd Vial Rack	777	C	2
555	D	2	45.0	ul TE	2nd Vial Rack	2nd Vial Rack	777	D	2
555	A	3	45.0	ul TE	2nd Vial Rack	2nd Vial Rack	777	A	3
555	B	3	45.0	ul TE	2nd Vial Rack	2nd Vial Rack	777	B	3
555	C	3	45.0	ul TE	2nd Vial Rack	2nd Vial Rack	777	C	3
555	D	3	45.0	ul TE	2nd Vial Rack	2nd Vial Rack	777	D	3
555	A	4	45.0	ul TE	2nd Vial Rack	2nd Vial Rack	777	A	4
555	B	4	45.0	ul TE	2nd Vial Rack	2nd Vial Rack	777	B	4
555	C	4	45.0	ul TE	2nd Vial Rack	2nd Vial Rack	777	C	4
555	D	4	45.0	ul TE	2nd Vial Rack	2nd Vial Rack	777	D	4
555	A	5	45.0	ul TE	2nd Vial Rack	2nd Vial Rack	777	A	5

Figure 8
WellAware Setup Data Entry Descriptions

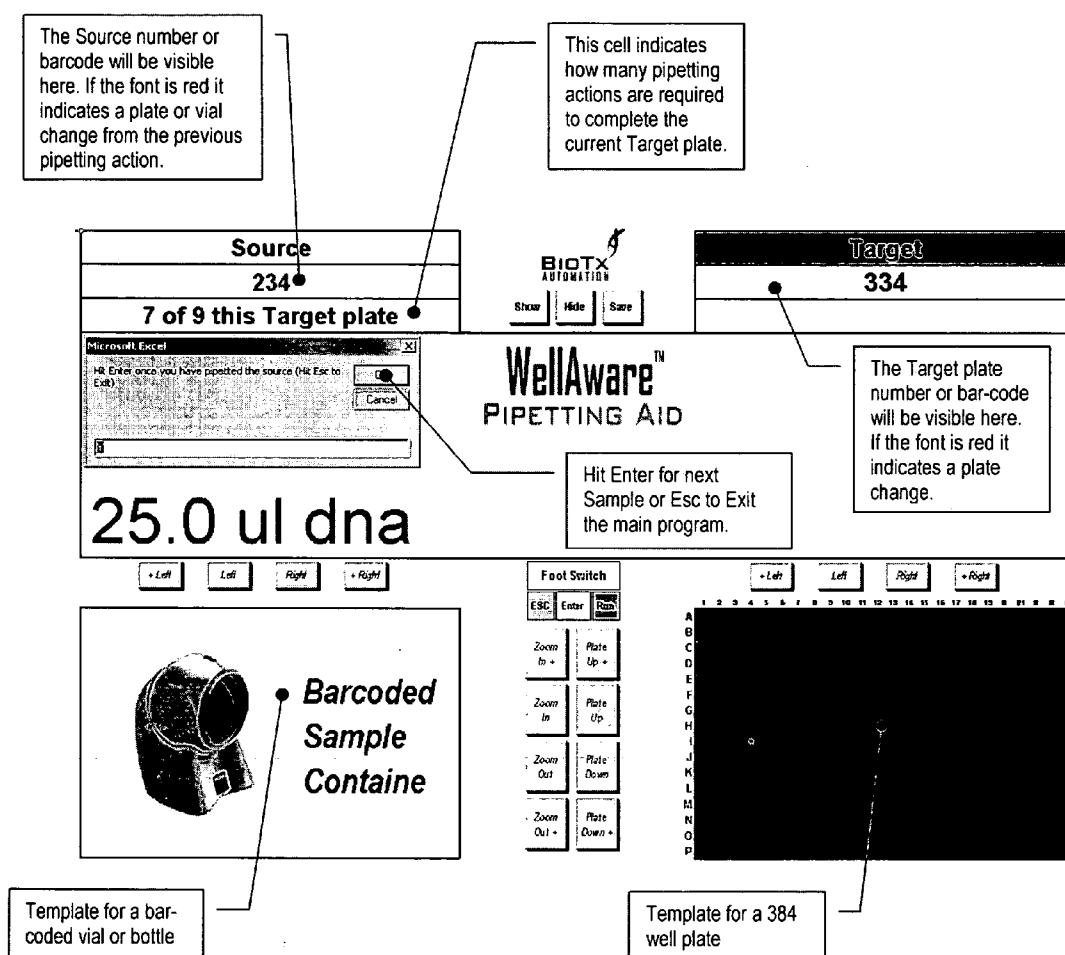


Figure 9
View of Main Program running a Bar-coded Source.

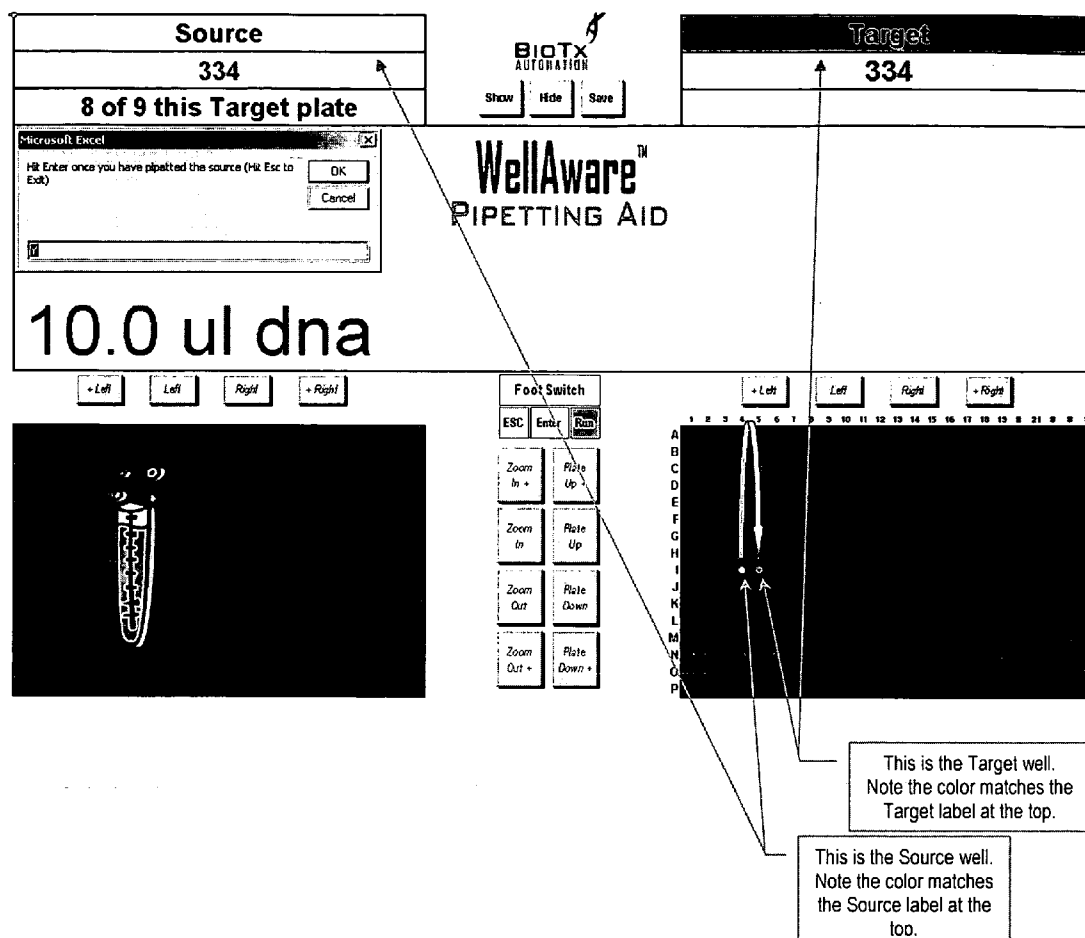
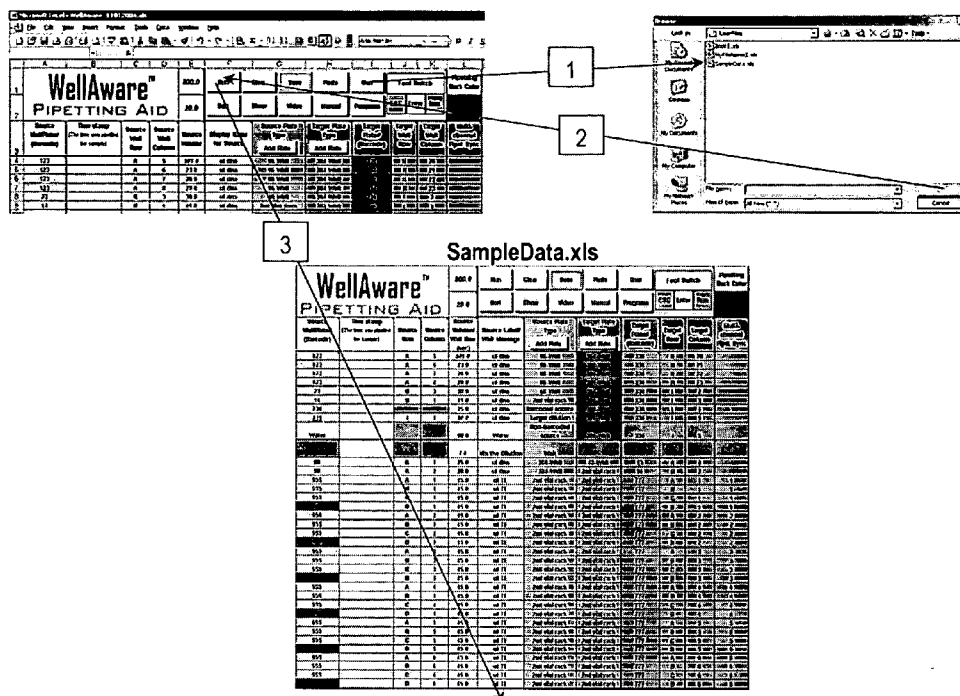
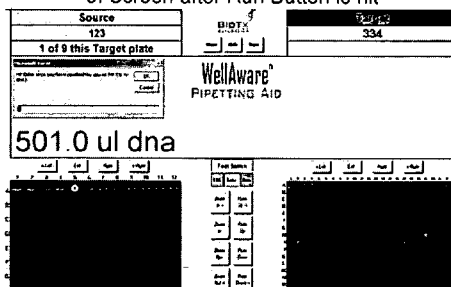


Figure 10
View of Main Program running a Target Plate Dilution.

Figure 11
Screen shots while running the WellAware main program on the data in the file C:\Program Files\WellAware\User Files\SampleData.xls.



3. Screen after Run Button is hit



4. After Enter Button is hit five more times a Source plate change

The screenshot shows the WellAware PIPETTING AID interface. At the top, there are three main sections: 'Source' with the value '23', a 'BIOTX' section with three buttons, and a 'Target' section with the value '334'. Below the 'Source' section, it says '5 of 9 this Target plate'. The main display area shows '38.0 ul dna'. At the bottom, there are two large black rectangular areas representing pipette tips, a central column of buttons, and a row of four small buttons at the very bottom.

5. Enter is hit one more time and another Source plate change

The screenshot shows the WellAware PIPETTING AID interface. At the top, there are three main sections: 'Source' with the value '14', a 'BIOTX' section with three buttons, and a 'Target' section with the value '334'. Below the 'Source' section, it says '6 of 9 this Target plate'. The main display area shows '41.0 ul dna'. At the bottom, there are two large black rectangular areas representing pipette tips, a central column of buttons, and a row of four small buttons at the very bottom.

6. Hit enter again and the next record is a bar-coded source.
This box comes up in preparation for a scanned bar-code value.

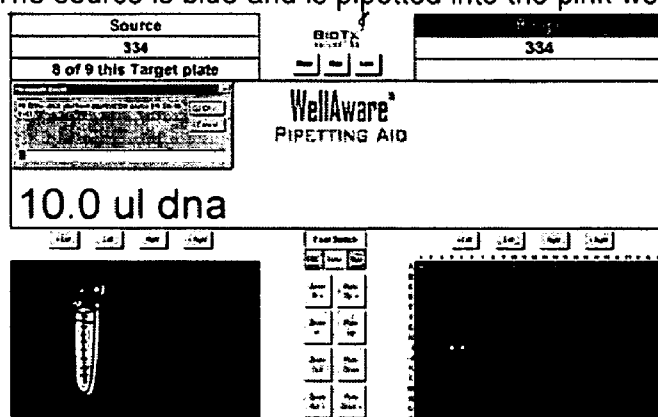
The screenshot shows a small rectangular box with a barcode at the top. Below the barcode, there is text that is partially legible but appears to be instructions or a warning. At the bottom right of the box, there are two buttons labeled 'OK' and 'Cancel'.

7. After the successful bar-code scan

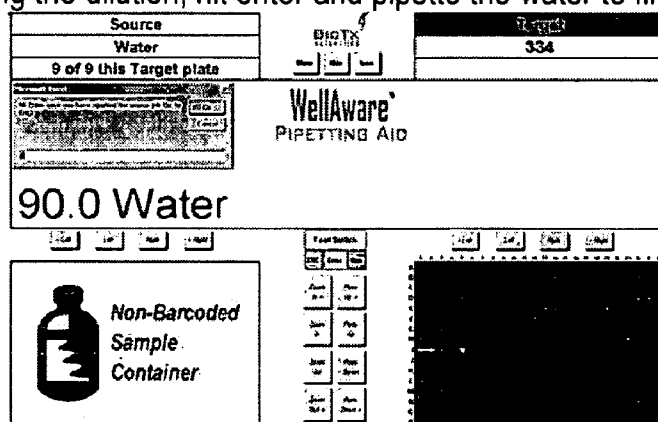
The screenshot shows the WellAware PIPETTING AID interface. At the top, there are three main sections: 'Source' with the value '234', a 'BIOTX' section with three buttons, and a 'Target' section with the value '334'. Below the 'Source' section, it says '7 of 9 this Target plate'. The main display area shows '25.0 ul dna'. At the bottom left, there is a small icon of a bar-coded sample container with the text 'Barcoded Sample Container' next to it. At the bottom, there are two large black rectangular areas representing pipette tips, a central column of buttons, and a row of four small buttons at the very bottom.

Figure 11A

8. Hit Enter after pipetting the bar-coded source.
This is a Target plate dilution both the Source and Target are in the Target plate.
The source is blue and is pipetted into the pink well.



9. After pipetting the dilution, hit enter and pipette the water to finish the dilution.



10. After hitting Enter, a 1sec Wait command is used to alert operator to mix the dilution

11. Next a Source and Target plate switch.

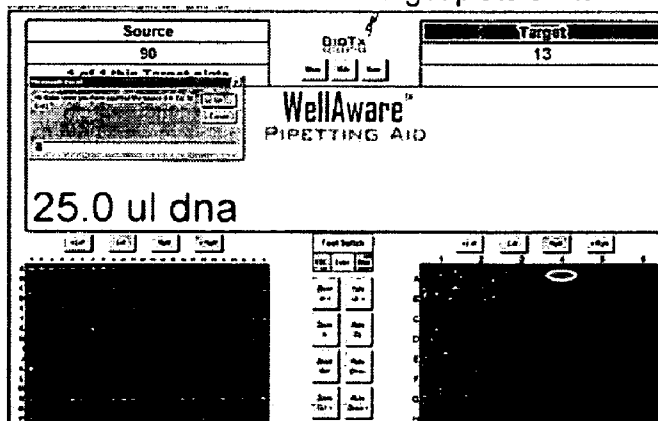
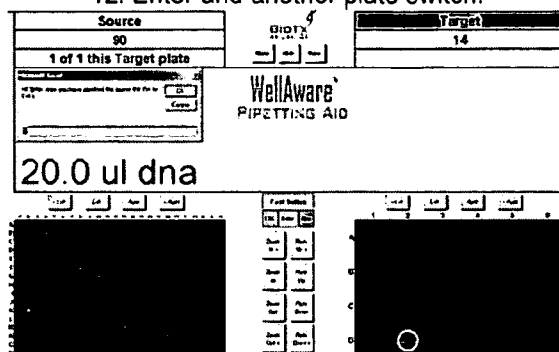
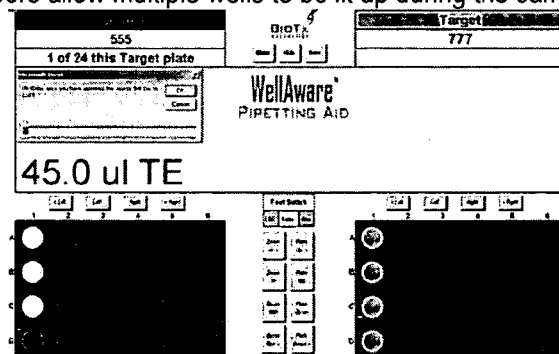


Figure 11B

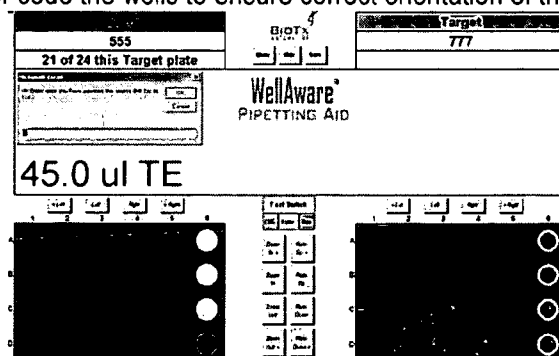
12. Enter and another plate switch.



13. After hitting enter, there is another Source and Target plate switch. This is an example of how to do multi-channel pipetting with WellAware. The sync numbers allow multiple wells to be lit up during the same pipetting step.



14. Hit enter five more times and you are at the end of the multi-channel pipetting example. Note the ability to color code the wells to ensure correct orientation of the multi-channel pipette.



15. Once the spreadsheet has been completed you will be notified.

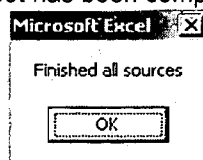
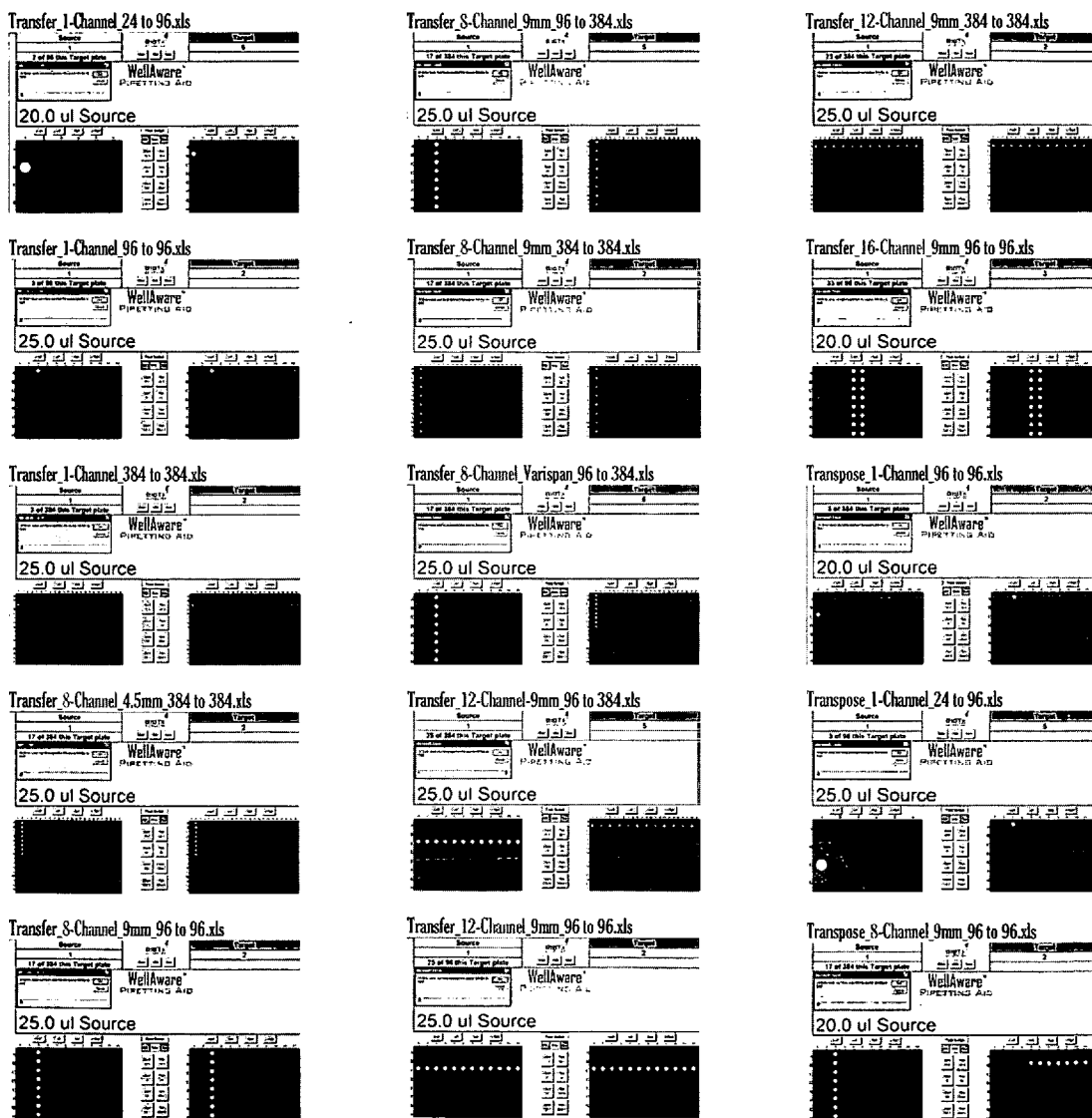


Figure 11C

Figure 12..
WellAware Programs with screen shots



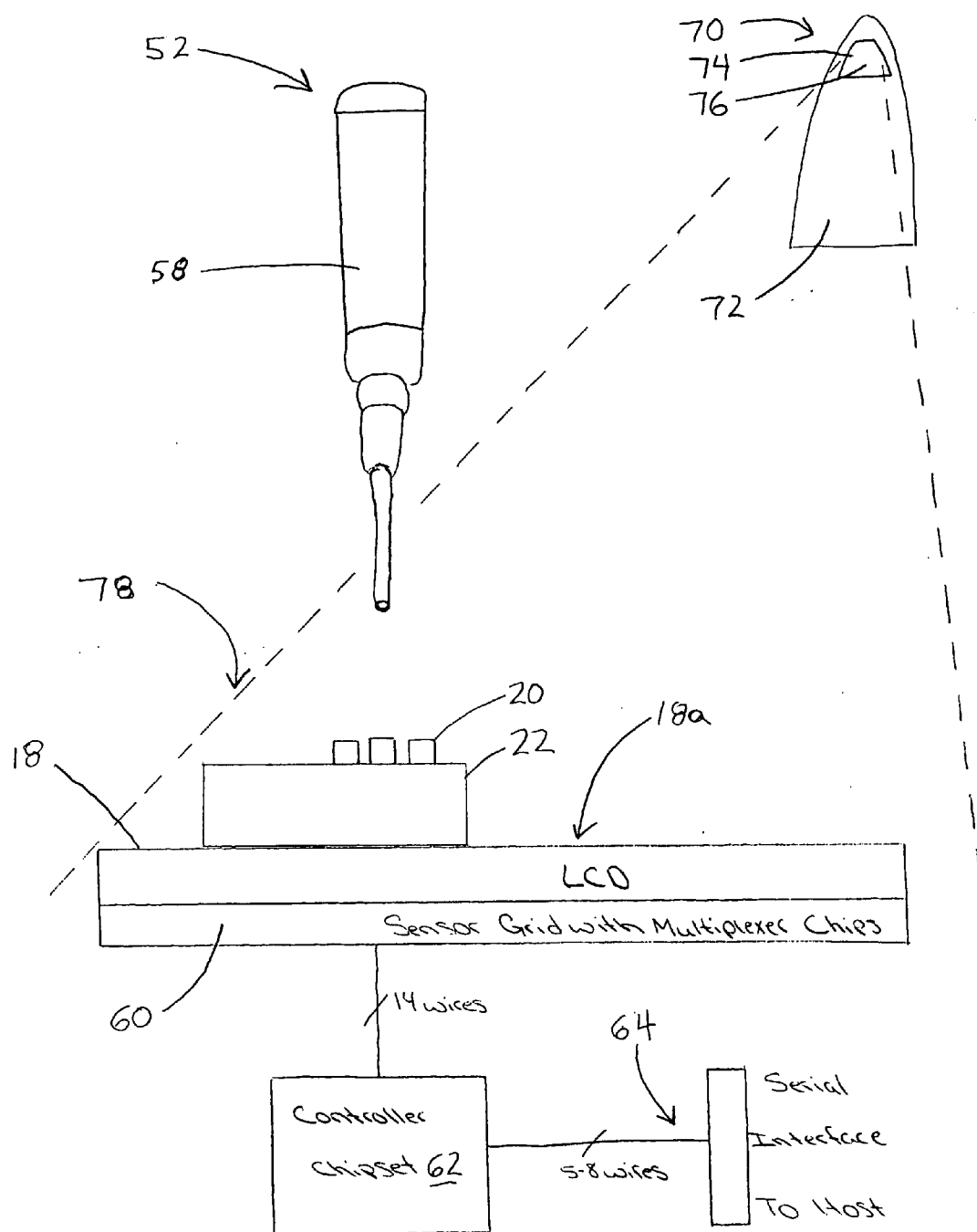


FIG. 13

SEMI-AUTOMATED PIPETTING AID

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is a continuation-in-part of U.S. Utility Patent Application Ser. No. 11/061,976 filed Feb. 18, 2005 and claims the benefit of same.

STATEMENTS REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

[0002] Not applicable.

REFERENCE TO A MICROFICHE APPENDIX

[0003] Not applicable.

BACKGROUND OF THE INVENTION

Description of the Related Art

[0004] In the past, vials containing various chemicals and/or samples (or empty vials awaiting pipetting) have been manually organized into well plates in a laboratory or facility. There is great opportunity for human error when attempting to organize numerous identical or nearly identical small vials into the tight space of a well plate or plates. One attempt to improve upon the prior systems is a system with a mounting surface incorporating light emitting diodes (LEDs) into the mounting surface. The LEDs are used to indicate the proper well in a plate for pipetting or vial handling. This is accomplished by placing a vial rack or plate on top of the LED mounting surface and using software to illuminate the correct LED for pipetting or handling.

BRIEF SUMMARY

[0005] A semi-automated pipetting apparatus has a computer monitor with a screen lying in at least a nearly horizontal plane. A screen protector is mounted over the screen. A processing unit runs a computer program and is in communication with the computer monitor to generate a screen display shown on the screen. The screen display indicates at least one target location for the placement of a vial or for pipetting. Another embodiment would project the computer display onto the top of the well plate or surface for directing a sorting process (which might be used in a shipping department to direct the picking of items from a pick list) or pipetting action.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0006] FIG. 1 is a schematic view of one embodiment of a semi-automated pipetting aid system.

[0007] FIG. 2 is a perspective view of one embodiment of a screen protector.

[0008] FIG. 3 is a perspective view of one embodiment of a pipettor with a wireless port/receiver.

[0009] FIG. 4 is a view of a spreadsheet generated as a screen display including schematic instructional text.

[0010] FIG. 5 is a view of a spreadsheet generated as a screen display including schematic instructional text.

[0011] FIG. 6 is a view of a spreadsheet generated as a screen display including schematic instructional text.

[0012] FIG. 7 is a view of a set-up screen display for calibrating the LCD screen including schematic instructional text.

[0013] FIG. 8 is a view of a data set-up screen display including schematic instructional text.

[0014] FIG. 9 is a view of a screen display for running a bar code scanner including schematic instructional text.

[0015] FIG. 10 is a view of a screen display for running a target plate dilution including schematic instructional text.

[0016] FIG. 11 is a view of several screen shots of screen displays taken while running the main computer program on data including schematic instructional text and sequence information.

[0017] FIG. 12 is a view of fifteen example screen displays generated as a result of running the main computer program including schematic reference information.

[0018] FIG. 13 is a schematic elevational view of one embodiment of an input device or pipette tip for a digitizer system.

DESCRIPTION of the EMBODIMENT(S)

[0019] Referring to FIGS. 1-2, the semi-automated pipetting aid 10 generally is used at workstation 11 and includes a computer monitor 12, a screen protector 30 mounted on the computer monitor 12 and one or more screen displays 16 shown on the computer monitor 12. A user performs a pipetting action or sorting action (e.g., transfers an item such as a vial 20 to/from the pipetting aid 10) by respectively, pipetting to or placing, vials 20 on the computer monitor 12 (or in a vial rack or well plate 22 placed upon the screen 18) as respectively indicated by a target location 17 shown on the screen display 16. The well plate 22 may, for example, be a twenty-four, forty-eight, ninety-six, three hundred eighty-four, or fifteen hundred and thirty-six transparent or semitransparent well plate. In one working example, the target location 17 may be represented by red lighted circle shown on the screen display 16.

[0020] The computer monitor 12 is preferably a flat panel computer monitor 13 in communication with a CPU 14 contained in computer 14a. The computer monitor 12 may be other than a flat panel computer monitor so long as it is functional for mounting well plates 22 over the outer surface 18a of screen 18. The outer surface 18a should lie in a horizontal plane or in a primarily horizontal plane so that the well plate(s) 22 and vials 20 will rest and stabilize over the screen 18 under the influence of gravity. Preferably the computer monitor 12 has swivel joints 19 such that the outer surface 18a of screen 18 can be rotated to the horizontal or to a plane slightly sloped from the horizontal as desired by the user. However those skilled in the art will realize that there are other ways to make the screen 18 horizontal or nearly horizontal, and that there are many types of swivel joints 19 which may be used in the overall design of the system. Also, if the screen 18 lies in a plane which is nearly horizontal such would mean that the slope of the screen 18 from the horizontal would be sufficient for the vials 20 to be stable on top of the screen 18.

[0021] The screen protector or cover 30 is preferably used in the system to protect the computer monitor 12 from chemicals and/or moisture. Hence, the screen protector 30 is preferably made of a chemically resistant, transparent material, e.g., polyethylene terephthalate ("PET") a polyester material. The screen protector 30 may be a sheet or layer 30a mounted over outer surface 18a of screen 18 or it may be embedded in/with the surface 18a. In the preferred embodiment, the screen protector 30 is made to match the computer monitor 12 including the surface 18a of the screen 18. Such a screen protector 30 has a planar interior surface 32 with sidewalls 34 adjoining to a raised peripheral surface 36. In one example, the interior surface 32 is approximately eleven inches by 8.25 inches, the sidewalls 34 are about $\frac{5}{16}$ th of an inch high, and the peripheral surface 36 is about from one-half inch to one inch wide. The screen protector 30 could include a template indicating a location for the proper placement of a well plate 22 and could also contain indexing points, protuberances or markers 38 (only a few are shown in FIG. 2 to represent this feature schematically) to prevent the improper orientation of a well plate 22. The screen protector 30 could be made in other manners such as, for example, a screen 18 with fluid tight joints.

[0022] The processing unit or CPU (central processing unit) 14 may be integral with or separate from the computer monitor 12. The CPU 14 will enable a computer program or software 15 to generate or create the screen display 16. In the current preferred embodiment MICROSOFT EXCEL software is the software 15 used to create the screen displays 16, including spreadsheets 16a, target locations 17, etc. One skilled in the art may implement other software 15.

[0023] A sample User Manual excerpt for using the software 15 appears below and FIGS. 4-12 are working examples of screen displays 16 generated by the software 15 (including additional reference information to assist in describing the use and functionality of the software together in the semi-automated pipetting aid 10 system):

[0024] The WellAware software has two tabs Setup and Pipetting. The Setup tab contains a table of information that the user may modify to customize pipetting functions (see FIG. 5). The user fills in the table with the Source: name, number, volume, units & well location and the Target: number, well location, vial or plate types and (if multi-channel pipetting)-a sync number.

[0025] The table may be filled out manually or the Add Plate wizards may be used to speed up data entry. The (Fill Color) button in EXCEL is used to set the Sample, Target and Background colors in WellAware. Simply select the Source or Target Plate number that you want to set the color for, click on the Fill Color button, and select the color you want. When the program is run, the Source or Target well will be lit up with the selected color. To change the Background color click on cell L2 on the Setup tab and select the Fill color you want. Once the Setup spreadsheet is filled in, the operator hits the right key on the footswitch or clicks the Run button (see FIG. 4) on the Setup spreadsheet. The software will light up the appropriate wells for pipetting on the LCD screen (see FIG. 9). Once the operator has finished the pipetting of the first sample, they hit the middle foot-switch button or the enter key. The program timestamps the pipetting action in the Setup spreadsheet and then will light up the next source to be pipetted. There is also a bar-code

function described in detail in the Accessories section of this manual and FIG. 11. If you want to save your pipetting data for future reference, you may hit the Save button to save your data to a new spreadsheet. You should note that you can't save data in WellAware other than through the Save button. If you ever wish to redo a saved pipetting spreadsheet click the User button, select the file you want to redo and the program will put it in the Setup spreadsheet for you. Alternatively, the user can simply copy data from a saved worksheet (cells A4 to L#####) then switch over to the WellAware Setup tab and click the Paste button. Before hitting Paste, make sure the data is in the same order as the Setup spreadsheet or the program will not function properly. The Paste button will paste the data into cell A4 and preserve the formatting in the WellAware Setup tab (by performing a paste special text only). It may then be necessary to remove the old timestamp data and add user specified color formatting for the Background, Target and Source before hitting the Run button. To clear the data and formatting from the Setup spreadsheet, use the Clear button. The Manual button and Video buttons are conveniently located on the Setup tab and provide easy access to this manual and instructional video.

[0026] Pipetting Options

[0027] The pipetting options are available for selection under the Source Plate Type and Target Plate Type list boxes on the Setup tab of WellAware. Please note that not all pipetting options are available under the Pipetting From list box.

[0028] Wait: This command is used to time a step in your protocol and/or alert the operator to do something with a message box. If you put a time in the program will wait the specified number of seconds, say the text message and finally display the message text in a message box. This selection is only available on the Source plate type pull down list. (FIG. 11) 24-Well: The 4x6 grid pattern may be used for vials or a 24-well plate. This selection is available on the Source and Target plate type pull down list. 384-Well: The 384-well plate selection is available on the Source and Target plate type pull down list.

[0029] 48-Well: The 48-well plate selection is available on the Source and Target plate type pull down list.

[0030] 96-Well: The 96-well plate selection is available on the Source and Target plate type pull down list.

[0031] Barcoded Source: Used for bar-coded vials or containers. This option is ideal for making or filling holes in master plates. This selection is only available on the Source plate type pull down list. (FIGS. 8, 9, & 11) Non-barcoded Source: This selection is used for bottles or reagent troughs (TE, water or a dilution solvent like DMSO). This selection is only available on the Source plate type pull down list. (FIGS. 8 & 11)

[0032] Target Dilution: This selection is used for doing serial or ratio dilutions in the Target plate. Both the Source and Target wells are illuminated on the same Target plate. This selection is only available on the Source plate type pull down list. (FIGS. 8, 10, & 11)

[0033] Common Pipetting Programs

[0034] The Programs button on the WellAware Setup tab provides access to a number of common pipetting

programs. Programs include transposing using single and 8-channel pipettors with various plate configurations. WellAware also includes programs for transfers using single, 8, 12 & 16-channel pipettors and 8-channel 9 mm to 4.5 mm variable span pipettors utilizing various plate configurations. **FIG. 12** includes screenshots of the current list of common pipetting functions. Bio TX will make new pipetting programs available on its website as they become available. To run these programs simply click the Programs button and select the program name that describes the activity you want to use and the data will be transferred to the Setup Tab for formatting and editing. Once the data is ready, hit the Run button to begin pipetting.

[0035] Customizable Screen

[0036] On the Pipetting Tab there is a series of buttons that will allow the user to custom configure the WellAware program to any computer screen (**FIG. 6**). If the screen is not properly formatted once you start one of the pipetting programs on the Programs tab of WellAware, simply hit the ESC to exit out of the program. Then hit the Hide button on the Pipetting Tab. Next, place your plates on the screen and use the Source and Target Left/Right buttons, the Plate Up/Down buttons and the Zoom In/Out buttons to configure the screen for your computer. Once the plate wells are aligned with the wells on the PC's screen, hit the Save button. Your settings are now saved and you can continue with your pipetting. The next time you open WellAware your changes will still be in effect. Detailed instructions for aligning the screen are provided in **FIG. 7** of this manual.

[0037] Accessories

[0038] Monitor & Screen cover—Bio TX has a 180-degree tilt modified fourteen inch LCD screen, which comes with a disposable chemical resistant screen cover. The covers are made of PET plastic and are resistant to most solvents, acids and bases (plastic soft drink bottles are made out of PET). The screen and the covers are available for purchase with or without the WellAware software.

[0039] Foot switch—A three-button USB foot switch is available for the hands-free operation of the WellAware programs. The Left button is the ESC key, the middle button is the Enter key and the right button is the combination of the Ctrl+Shift+R the equivalent of hitting the Run button on the Setup tab of WellAware.

[0040] Barcode reader—The main WellAware program can be used with bar-coded vials or containers. It is recommended that all bar-coded vials be grouped together in the Setup spreadsheet before hitting the Run button and that all bar-coded vials be processed at the same time. When a bar-coded record is encountered by the software an input box, will pop-up and ask the operator to scan the barcode. When the barcode is scanned, the correct record is found in the Setup spreadsheet and the correct Target well is illuminated. This function is ideal for making master plates from vials, filling holes in master plates, cherry picking and combi-chem type applications.

The software **15** may be used in conjunction with a computer network and with more than one computer

monitor. For example, a user may desire to make data entries while viewing a display **26** on a second computer monitor **24** whilst the computer monitor **12** is used for the organized placement and arrangement of vials **20**.

[0041] The screen display **16** works in conjunction with (is generated by) the CPU **14** and software **15** to indicate a target location **17** for each vial **20** on the screen display **16**. The target location **17** is principally represented by a visual cue, such as, by way of example, a red light appearing within what was previously a white circle appearing against a black background. Other cues such as an audible cue or text to speech (voice prompting) may be used as well. For example, an audible cue may be used to inform the operator that the screen display **16** is ready for placement of a vial **20** which was just bar code scanned by a linked scanner **28** into the system.

[0042] In another example, the screen protector **30** is mounted over outer surface **18a** on the computer monitor **16**. A semi-transparent well plate **22** is placed on the screen protector **30** in a location indicated by lights on the screen display **16**. The screen display **16** then lights up a red light which can be seen through the semi-transparent well plate **22** to indicate to the operator where a vial **20** should be transferred and placed within the well plate **22**. The CPU **14** will process data so that a record is kept of the placement location and contents of each individual vial **20**.

[0043] A foot control **40** may be used with the semi-automated pipetting aid **10**. The foot control **40** can be used by the operator to, for example, cue the system that the operator has completed a specific or specified task, to move on to the next transfer, etc. The foot control allows the operator's hands to be free to pipet liquids into vials **20** or plates **22**, scan bar codes located on vials **20**, apply bar code labels, etc.

[0044] A wired or wireless, or "bluetooth" system **50** can be added to the overall system. The wireless or "bluetooth" system **50** (other wireless communication protocols could be implemented into the wireless system **50**, and ZIGBEE promoted by the ZigBee Alliance including Philips Electronics is presently one preferred wireless communication protocol option) is used to automate volumetric dispensation from a stand-alone pipette header **52**. In such a system **50**, the computer sends volumetric dispensation data to the pipette header **52**. This will automate the volume of a liquid dispensed into a vial **20** (e.g. 9.5 milliliters) once the operator simply initiates the dispensation of the liquid into a vial **20**. A "bluetooth" or wireless card **54** is mounted in the computer **14a**, and a "bluetooth" or wireless port/receiver **56** is located in the pipette header **52**. As known to one of ordinary skill in the art, the wireless port/receiver **56** can be used to implement control signals and functionality for the pipette header **52**.

[0045] The software **15** generated spreadsheet **16a** (**FIGS. 4-12**) may be used to program in all actions of a protocol including wait/pause and action steps. This allows any operator of the software **15** to repeat a protocol at a later time with increased reproducibility. In addition, very complex protocols may be attempted whereas previously such complex protocols would not normally be attempted due to the high probability of user error.

[0046] The end of the pipetting device or pipette tip **58** may be used for transmitting digital communications. In this

option, the pipette tip **58** functions as an input device and contains electronics/circuitry (e.g., such as a stylus with a MICROSOFT Tablet PC) thereby being external to the outer surface **18a** of the screen **18**. In this embodiment, the pipette tip **58** uses electromagnetic technology to transmit information about the pipette header's **52** location or position, via the pipette tip **58**, to the sensor grid **60** located behind the screen/liquid crystal display **18**. The controller's chipset **62** uses this information to create digital data used by the computer **14a** as communicated by a device such as line **64**. A schematic of a typical input device or pipette tip **58** for a digitizer system is shown in **FIG. 13**.

[0047] A detector by light projection device **70** may also be implemented into the system. The light projection device **70** has a tower **72**, a light (e.g. laser) projector **74** mounted in the tower **72**, and a sensor system **76** mounted in the tower **72** to detect and feedback positional data with respect to the projected light.

[0048] In the use of the embodiment represented by **FIG. 13**, the system software (WellAware) **15** can be used to direct many functions all of which may be used independently or combined together in different combinations as desired by the user. First, the system may be used to direct aspiration and/or dispensation of a substance to a well **22** or vial **20**, to direct the location where such should occur, and/or capture where such has occurred. Second, the system may prevent/block an actual pipetting aspiration or dispensation action, if the pipette tip **58** is not positioned over the correct well plate **22** and/or vial **20**, or if the pipette tip **58** is not properly aligned over a vial **20**. Third, the system may direct playback of prior actions taken and/or the location of pipetting steps taken (individually or in sequence) allowing the user to verify or check for errors and to document the pipetting actions. Fourth, the detector by light projection device **70** may be used to project a lighted area **78** superimposed over the screen **18** or well plate **22** to detect whether a pipette tip **58** has moved over and/or entered a vial **20** or a well plate **22**, and/or to detect and record where a tip **58** is moving. The light projected area **78**, for example, is a pattern matching the opening pattern of a well plate **22**. The foot control **40** could be eliminated in the **FIG. 13** embodiment(s) without loss of functionality.

What is claimed is:

1. A semi-automated pipetting apparatus, comprising:
 - an illuminated surface lying in a nearly horizontal plane wherein said illuminated surface is selected from the group of illuminated surfaces consisting of a computer monitor screen, and a light projected area generated by a light projection device;
 - a processing unit running a computer program in communication with said illuminated surface;
 - a screen display generated by the processing unit and the computer program, and shown on said illuminated surface; and
 - wherein the screen display indicates at least one target location for taking an action selected from the group of actions consisting of pipetting and sorting an item.
2. The apparatus according to claim 1 further including a means for protecting said computer monitor located on said computer monitor screen.

3. The apparatus according to claim 2 wherein said means for protecting said computer monitor screen comprises a screen protector layer mounted on an outer surface of said computer monitor screen.

4. The apparatus according to claim 3 wherein said screen protector layer comprises a planar interior surface, an adjoining sidewall, and an adjoining raised peripheral surface.

5. The apparatus according to claim 3 wherein said screen protector layer is made of polyethylene terephthalate.

6. The apparatus according to claim 2 wherein said means for protecting said computer monitor screen includes at least one well plate marker.

7. The apparatus according to claim 1 wherein said computer monitor screen is a flat panel computer monitor.

8. The apparatus according to claim 1 wherein said computer monitor screen includes a stand and a swivel joint joining said stand to said computer monitor screen.

9. The apparatus according to claim 1, further including a foot control in communication with the processing unit.

10. The apparatus according to claim 1, further including a second computer monitor in communication with the processing unit.

11. The apparatus according to claim 10, wherein the second computer monitor has a display which is different than that shown on the screen display.

12. The apparatus according to claim 1, further including: a stand-alone pipette header including a first transmitter and a first receiver having a means for controlling said stand-alone pipette header; and a second transmitter and a second receiver connected to a computer and in communication with the processing unit and with the first receiver and the first transmitter.

13. The apparatus according to claim 1, wherein the computer program is MICROSOFT EXCEL.

14. The apparatus according to claim 1, further including a scanner in communication with the processing unit and at least one bar code label applied to a device selected from the group of devices consisting of a vial, and a plate.

15. The apparatus according to claim 1 further including:

a pipetting device having an electronic means for transmitting electromagnetic communications mounted thereon;

a sensor grid located behind the screen;

a controller chipset connected to the sensor grid for processing information about a position of the pipetting device; and

a means for communicating between the controller chipset and the computer program.

16. The apparatus according to claim 1 wherein the light projected area generated by a light projection device further includes:

said light projection device mounted proximate said computer monitor;

wherein said light projection device has a light projector and a light sensor mounted thereon;

the light projected area generated by said light projector proximate said computer monitor; and

a means for communicating between said light projection device and the processing unit.

17. A method for semi-automating the filling of vials in a laboratory, comprising the steps of:

placing an illuminated surface such that the illuminated surface lies in a nearly horizontal plane, wherein the illuminated surface is selected from the group of illuminated surfaces consisting of a computer monitor screen, and a light projected area generated by a light projection device;

generating a screen display via a processing unit running a computer program in communication with the computer monitor;

indicating at least one target location on the screen display for taking an action selected from the group of actions consisting of pipetting and sorting an item; and

taking an action selected from the group of actions consisting of pipetting and sorting an item on top of the screen display and the target location.

18. The method according to claim 17 wherein said step of placing the computer monitor comprises adjusting an angle of the screen of the computer monitor.

19. The method according to claim 17 further comprising the step of controlling the screen display by motion of foot.

20. The method according to claim 17, further comprising the steps of:

sending signals from a computer to a stand-alone pipette header; and

controlling a volume of liquid to be pipetted by the stand-alone pipette header by means of said prior step.

21. The method according to claim 20, further comprising the step of indicating completion of said controlling step by sending a communication signal back from the stand-alone pipet header to the computer program.

22. The method according to claim 17, further comprising the step of programming actions of a protocol for the filling of vials via the computer program.

23. The method according to claim 22, wherein said step of programming actions of the protocol includes steps of pausing for the filling of vials and subsequently acting to fill at least one vial.

24. The method according to claim 22, further including the step of repeating the protocol at a later time.

25. The method according to claim 17, further comprising the step of providing an audible cue for prompting an operator-initiated response.

26. The method according to claim 17, further comprising the step of placing a screen protector on top of the illuminated surface.

27. The method according to claim 17 wherein the step of indicating the target location for the vial on the screen display includes scanning a bar code label.

28. The method according to claim 20, wherein said step of sending signals from the computer to the stand-alone pipette header comprises sending a wireless signal.

29. The method according to claim 20, wherein said step of sending signals from the computer to the stand-alone pipette header comprises sending signals on a hard-wired line.

30. The method according to claim 17, further including generating a signal from a pipette; and tracking a position of the pipette by the signal.

31. The method according to claim 17, wherein said step of placing an illuminated surface comprises projecting a light pattern; and detecting a position of a pipette by the light pattern.

32. The method according to claim 17, further comprising the step of programming actions of a protocol for the sorting of items via the computer program.

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